U. S. FOREST SERVICE

RESEARCH NOTE NC-102

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FOREST FLOOR CHARACTERISTICS IN SOUTHWESTERN WISCONSIN

ABSTRACT. — Percent slope, aspect, topographic position, and crown closure were found to have no significant influence on forest floor depth in southwestern Wisconsin. However, a significant decrease in forest floor depth and an increase in soil compaction were found on currently grazed slopes. Yet when grazing is stopped recovery is apparently quick with no permanent damage.

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The hydrologic response of wooded slopes to precipitation is strongly influenced by forest floor litter and humus. These elements maintain a high infiltration rate by protecting the soil from raindrop impact, thus preventing compaction and the clogging of soil pores by dislodged particles. Deep humus layers also hold large quantities of water in temporary storage.

To find out how forest floor characteristics were related to site variables (including grazing) in southwestern Wisconsin, a litter and humus depth survey was conducted on the Coulee Experimental Forest.

THE AREA

The forest is located in the Driftless Area of southwest Wisconsin. The terrain is best described as a dissected plateau having broad ridges, steep slopes, and narrow valleys. Generally, the ridges and valleys are cultivated, with tilling on slopes up to about 20 percent. The forests are "sandwiched" between the upper and lower tilled areas on slopes that average about 40 percent. The oak-hickory forests in the study area were high-graded, burned, and grazed since settlement in the mid-1800's until the land was purchased by the State of Wisconsin in 1960. The soils are primarily loessal Fayette and Dubuque silt loams with the exception of the steeper slopes, which have been classified as Rough Broken Land and Rock Land with no soil series identification. The summers are warm and humid and the winters are cold and dry. Average annual precipitation is 32 inches; about 70 percent occurs during the growing season.

PROCEDURE

One-fifth-acre plots were located on selected wooded slopes using line transects that followed the slope contour. At each plot, site and stand variables were measured or identified as follows:

Variable	*Grouping*
Topographic position	Upper, middle, and lower slope
Aspect (azimuth)	1-90°, 91-180°, 181-270°, and 271-360°
Slope	0-25%, 26-35%, 36-45%, and 46% +
Disturbance	Currently grazed or currently ungrazed
Crown closure	0-40%, 41-70%, and 71-100%

Current grazing intensity was judged as medium with small areas of heavy localized damage. No quantitative estimate of grazing intensity was made.

The forest floor layers were measured to the nearest 0.5 cm. (0.2 in.) at four locations in each plot, and humus type was classified according to Hoover

and Lunt.[1] The traditional designations were used in classifying forest floor layers: L, undecomposed leaves and twigs; F, partially decomposed organic matter but recognizable as to origin; and A_1, the top layer of mineral soil, which has a mixture of organic and mineral fractions and a diffuse lower boundary.

The field work was done in July and August of 1969. Although 196 plots were located in the field, 16 plots were not sampled because they occurred either on alluvium from cultivated ridgetops, in gullies, or on abandoned roads.

In the analysis, mean humus depth among groups within each variable was examined, and each variable was examined independently. When trends or differences in means occurred, they were tested for significance using a "t" test at the 0.05 level of probability.

FOREST FLOOR CHARACTERISTICS

None of the site and stand variables examined were found to explain variation in humus depth. Localized variation was measured but was probably related to changes in micro-relief, soil properties, and past disturbances. Although a more sensitive study might detect some relationships, it is doubtful that the differences are large enough to have hydrologic significance. For research and management purposes the ungrazed forest floor of the study area can be considered uniform.

Effects of grazing on both depth and type of humus were measured. Average forest floor depths by layers are summarized in table 1. In addition to being shallower, the L and F layers on grazed plots were discontinuous. In areas where the mineral soil was exposed, sheet erosion was apparent and probably contributed to the shallower humus layers.

Percent of humus types on ungrazed and grazed plots was as follows:

Humus type	*Ungrazed*	*Grazed*
Firm mull	0	54
Sand mull	13	28
Coarse mull	12	5
Medium mull	67	13
Fine mull	9	0
Total	100	100

The humus type most frequently found on grazed plots was a firm mull, indicating that the forest floor had been compacted. Compaction and sheet erosion reduced humus depth on grazed plots, which supports long-standing evidence that grazing reduces the protective properties of litter, soil infiltration rates, and temporary water storage capacity.

The currently ungrazed plots studied had a long history of grazing, logging, and burning prior to 1960, yet today they have a deep, porous, forest floor. Although we cannot say exactly how long it has been since these slopes were last disturbed, it is apparent that recovery occurs quickly.

Table 1. — *Average litter and humus depths by layers and grazing status*
(In centimeters)

Humus layer	Ungrazed	Grazed
L	0.8	0.4
F	1.1	.3
A_1	7.4	6.4
F and A_1	8.5	6.7

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[1] *M. D. Hoover and H. A. Lunt. A key for the classification of forest humus type. Soil Sci. Soc. Amer. Proc. 16: 368-370, 1952.*